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A method for the operation of a panel placement system for punching presses and connection means to carry out the method

The invention relates to a method for the operation of a panel placement system for punching presses according to the preamble of claim 1.

Panel placement systems serve for delivering positioned panels, e.g. made of aluminum, to a punching press which punches out a predetermined number of blanks from the panel. EP 0 539 669 has made known a panel placement system in which the first gripping means seizes a panel on opposed sides at a transfer position. The panel is moved to the transfer position by second gripping means which engage the rear edge of the panel. The transfer position corresponds to a position of the panel in which the punch performs a first punching stroke on the panel. The feed slide having the second gripping means brings the panel to the transfer position only after the first gripping means have reached their pick-up position along the two axes. The first gripping means are adjustable along two orthogonal axes to allow an offset pitch to be chosen for the surfaces to be punched out, for a favorable material utilization. As was mentioned the transfer of the panel to the first gripping means at the transfer position takes place during the first punching step during which the panel is fixed by the punching die. After the machining of the preceding panel ends the two axes of the feed for the first gripping means and the feed slide travel to the initial and pick-up position in which a new panel is picked up. The panel placement system described helps to significantly reduce the transfer time for the panels with the press continuing to run. Nevertheless, there is at least one idle stroke between the punching step of a preceding panel and the first punching step of the succeeding panel. The idle stroke could possibly be avoided by lowering the die ring. However, the benefit which is achievable is brought about at the expense of positioning errors as the panel is pulled down during the last cut.

During the last stroke of the known placement system, one of the two pairs of feed pliers is directly at one of the outer dies. If it is to be ensured that the upper edge of the lower gripper mouth defines a plane with the die ring to prevent the panel from being pulled down during the last stroke the pliers are in a specifically formed pocket of the lower die ring when cutting diameters are small (<100 mm). The panel which is newly to be introduced has to be passed through under the feed pliers. However, this can be accomplished only after the pliers are moved back a sufficient length to leave enough space for the panel which is moving in. The front edge of the panel which is newly to be introduced has to be raised to the level of the die ring. Even if pockets do not require to be provided in the die rings when cutting diameters are larger it is then difficult for thicker metal sheets to get through between the pliers and the die ring. The gap between the pliers and the die ring can also be released by raising the pliers. However, this procedure takes time. Also, a panel placement system is known in which the gripping pliers engage the rear panel edge. Also in this constellation, however, the gripping pliers will be at an position identical to a die ring as in the previously described system during the last stroke. A more precise look during the engagement effected on the rear edge reveals, however, that if there is a diagonal feed only the pushing pliers act during a change of row. This results in a start of acceleration only at certain points and causes a diagonal formation of waves which takes a very long time to pass through the entire panel. Not until the panel lies in a flat condition again precise punching is possible. A dynamic operation is no longer possible from the moment at which the undulary motion begins. The problem specifically occurs at the start of panel machining when the panel still has its full size and the distance of the pliers from the die is minimal.

The punching press runs so fast as is allowed by this feed motion. Then, however, no time will be left for the panel to undergo additional handling such as lifting or carrying away. Thus, this lack of time results in a reduction of the possible

number of revolutions of the press and, hence, a reduction of the performance of the entire system. This same applies to all panel feed systems which are known.

As mentioned already, the known gripping means are formed by pliers. The pliers wear rapidly, primarily when panels of chromium-plated sheet steel are employed. The chromium will crumble off the panel edges and causes debris to work into the mouths of the pliers. Wear also takes place in the joints of the pliers. Since the plier size has to be small there is a need to provide bearings of a simple construction only, which further increases wear.

When punching is done in the final row the stability of the remaining grid will usually collapse because the residual sheet metal pieces are only left suspended in webs and, therefore, are still joined to the gripping pliers only to a limited extent. This causes dimensional variations with respect to the position of the panel in the die.

It is the object of the invention to provide a method for the operation of a panel placement system for punching presses which avoids any idle stroke while having a high press speed, allows to guide the panel in a stable fashion, and permits operation with nearly no wear.

The object is achieved by the features of claim 1.

In the inventive method, first connection means of the feed motion seize the panel exclusively from above in a rear edge area which is located between the rear edge and the surfaces to be punched out. What is understood by the surfaces to be punched out here is the final row of the surfaces to be punched out, based on the direction of feed.

The rear edge area can be seized by means of the first connection means in a variety of ways and manners. An aspect of the invention provides that the connection means seize the rear edge area via a vacuum. According to the invention, another possibility is that the connection means seize the rear edge area electromagnetically.

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Seizing the rear edge area via a vacuum and/or electromagnetically causes a frictional fit between the connection means and the panel. To improve the possibility for a work drive an aspect of the invention provides that the connection means seize the panel by means of pointed projections which penetrate into the rear edge area of the panel when the connection means seize the edge area. This establishes a positive fit between the connection means and the panel.

The projections of the first connection means can be formed by pin-like spikes which penetrate into the panel, which spikes can be disposed within suction ports of vacuum nozzles, according to an aspect of the invention. At the moment the panel is pressed against the nozzle a spike of the nozzle penetrates into the panel fully or partially. Even if the steel was cold-rolled twice the spikes can penetrate through a panel which is 0.18 mm thick, for example.

The connection means may be disposed on at least one ledge which cause portions thereof to engage gores which are defined between the rear edge of the panel and the surfaces to be punched out. For example, the ledge can present one or more suction ports which are connected to a vacuum source.

For an interengagement of the connection means and the panel, it is necessary either for the connection means to carry out a lifting motion in order to be lowered against the panel and to be moved up again subsequently in order that the panel be advanced in the plane of cut. Alternatively, it is also possible to maintain the connection means at a constant height and to raise the panel or rear end of the panel at the transfer position instead to establish the frictional fit or positive fit with the first connection means.

The inventive method uses areas of the panel which are not punched out, for the connection means. Usually, the panels in question are those which leave vacant spaces between the cuts, which mostly are of a round or non-rectangularly formed shape, and the rear edge. In the invention, those vacant surfaces are utilized for seizing and shifting the panels.

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The further advantage of the invention is that a panel, while undergoing the final punching cut, is not pulled around, but the preceding panel can be pulled out rearwards instead and a fresh panel can be readily pushed in by a feed slide underneath.

The inventive method can be employed for all panel feed systems which are known. It is usable for panel placement systems which operate with a feed slide which conveys the panels from an aligning station to a transfer station in which they are seized by the connection means of the feed slide and are advanced to the punching press. The invention is also applicable to so-called four-axis systems in which the feed slides fetch the panels directly from the aligning station and advance them to the punching press. In this case, two feed slides are provided which alternately advance the seized panels to the punching press. The essential thing of all feed systems, if they use the inventive method, is that each next panel that follows is pushed into the punching press with no idle stroke and with no need to reduce the number of revolutions of the press as compared to its possible punch-out speed or to make other provisions apt to avoid a delay in time while the succeeding panel is pushed in and after the final row of openings is punched into the preceding panel.

In the inventive method, the time required to pick up and take over a panel is exceptionally short and allows to operate without any idle stroke without reducing the number of revolutions of the press.

Another advantage of the invention is that better guidance is possible because of the way the panel is seized, specifically when the panel is large and thin. While the panel is fixed according to the invention the force can be introduced across the entire panel width and undulary motions or the like can be avoided during a dynamic operation. This makes possible considerably larger accelerations and higher performances.

Finally, this obtains the advantage that if the panel is seized according to the invention the stability of the remaining grid is distinctly higher than in known

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methods. It avoids dimensional variations which can occur because of the collapse of the grid pieces which are left behind.

The invention will be described in more detail below with reference to an embodiment thereof.

Fig. 1 shows a plan view of a schematically shown panel placement system including means of the invention during the transfer from an advancement slide to a feed device.

Fig. 2 shows a representation similar to Fig. 1 with a panel after the end of machining.

Fig. 3 shows a section taken through the representation of Fig. 1 along the line 3-3.

Fig. 4 shows the view 4 of Fig. 1.

Fig. 5 shows the view 4 of Fig. 2.

In Figures 1 and 2, a punching press of a conventional design type is designated by 10. It has three punching dies 12 which are moved perpendicularly to the plane of the drawing by means of a ram. A feed slide 16 is adjustable along a guideway 18 in the direction of the two-ended arrow 20. The feed slide 16 has holders 22, 24 for a gripper ledge 25 as a first connection means. Reference to the structure of the ledges 25 will be made later. The slide 16 and the holders 22, 24 are actuated by appropriate adjustable drives which are not shown and, in turn, are controlled by a suitable control device.

An advancement slide 30 (only shown in Fig. 1) having two pairs of gripping pliers 32, 34 as second connection means is adjustable along a slide guideway 36 in the direction of the two-ended arrow 38. The drive of the slide 30 is not shown either. However, a frictional fit by the advancement slide is perceivable, e.g. by magnetic force or a vacuum.

The gripping pliers 32, 34 can be of a conventional structure, e.g. a non-movable jaw 35 as a lower mouth and a movable jaw 37 as a upper mouth with the movable jaw 37 actuated by an appropriate drive which is not shown (see Fig. 3).

As can be recognized from Figures 1 and 2 the contour of the ledge 25 is such that it engages the gores by portions which are formed between the surfaces to be punched out in the respective rear row and the rear edge. The ledge 25 is always above the panel 40a and 40. It is shown in cross-section in Figures 4 and 5.

In Figures 4 and 5, at the underside of the ledge, a recess 50 can be seen to which a duct 52 is led via a suitable connection 54 which is not shown in more detail. The duct 52 is connected to a vacuum source which is not shown so that the recess 50 is under a negative pressure. Therefore, such negative pressure helps in holding the panel 40a and 40 by the ledge 25.

A pin-like spike 56 is centrally disposed in the recess 50. When the panel 40 or 40a is held against the ledge 25 the spike 56 will penetrate into the material of the panel 40a or 40 so that the panel is also held in a positive fit. In this manner, it is possible to advance the panel 40a or 40 to the press 10 as desired.

The ledge 25 can have a plurality of such connections means as shown in Figures 4 and 5 in order to seize the panel 40a or 40 across a large width.

Referring to Figs. 4 and 5, it should be noted that the rear panel edge, in reality, ends much closer to the die than is shown. A measure of 1 mm is common between the edge and the cut. Accordingly, the fixation point will then be between the male dies rather than in front thereof.

Fig. 2 shows a panel 40 to be machined at a position in which the final punching step is performed. Once the punching dies 12 are in engagement with the panel 40 the ledge 25 can be brought out of engagement with the panel or the grid which has remained, e.g. by a change-over from the vacuum to compressed air. The feed slide 16 runs back to a transfer position as is shown in Fig. 1. The gripping pliers 32, 34 have seized a fresh panel already during this time. When the ledge 25

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has reached its position along the transverse axis 21 the pick-up position on this axis is reached as well. Thus, while the advancement slide 30 advances the fresh panel 40a along the longitudinal axis 20 towards the punching press 10 the ledge 25 will move because of the return motion of the feed slide 16 and, thus, the panel 40a can be smoothly advanced into the press 10. The transfer position corresponds to that position in which the punching dies 12 carry out the first cut. The advancement slide 30 can smoothly advance the succeeding panel below the machined panel as results from Figures 4 and 5. They allow to see the table top 60 on which the panel is advanced. Once the panel has reached the transfer position of Fig. 4 (panel 40a) it is raised against the underside of the ledge 25 by means of at least one lifting plunger 62 which is actuated by a lifting drive, which is not shown, in the direction of the double-ended arrow 64 so that the spike 56 can penetrate through the panel 40a. The plunger 62 is extended through an opening 66 of the table top and is shifted back to the initial position immediately after the lift. Now, the feed slide 16 can advance the panel to the punching press in the manner described until the final cut is made as shown in Fig. 5. Fig. 5 shows a male die 68 and a female die 70 of the punching dies 12. The underside of the ledge 25 exactly corresponds to the cutting plane of the dies 68, 70.

The panel can also be raised, at least across some part of its width, by raising the advancement slide.

At the moment at which the punching dies 68, 70 make cuts into the panel 40 while fixing it at the same time the gripping pliers 32, 34 are opened and the plunger 62 lifts the panel 40a against the ledge 25 (Fig. 4), thus causing the transfer to take place from the advancement slide 30 to the feed slide 16.

The principle shown allows to bring about the feed of the panels with no idle strokes of the punching press. The panels 40 and 40a are safely seized by the ledge 25 using the connection means shown so that deformations of the panels that are caused by the feed motions will not occur. Since the panels are seized across a wide

surface within the rear edge area the remaining grid will be stabilized also during the final punching step.

The remaining grid can be released from the ledge 25, for example, by the nozzles 50 generating a pressure surge which moves the remaining grid down.